Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

A FACTOR IN MENTAL DEVELOPMENT.

WHEN we trace the development of mental life upward from the lowest forms of the animal kingdom, we are led to believe that the process has been marked chiefly by progress in two respects: first, advance in the power to discriminate among stimuli, and second, the rise, somewhere in the course of development, of the power to form 'free ideas.' Another mile-stone in the path of development is the beginning of social or ejective consciousness; but this, as the writer has elsewhere attempted to suggest, may have grown out of the power to form free ideas in situations where motor reactions of a social nature have already been produced through the influence of the creature's needs. It is the aim of the present paper to indicate how both these great gains of psychic evolution, discrimination of present experiences and clearly conscious recall of past experiences, have been dependent in part at least upon one factor: the organism's growing power to react to stimuli not in immediate contact with the body.

Let us take up first the matter of discrimination. The external senses are grouped as higher and lower according to the number of discriminable qualities they furnish, from sight with its thousands down to warmth and cold with their one each. In the course of organic development, the power of primitive living beings to react to light and darkness has grown into the painter's capacity to distinguish color tones and saturation grades; the original shock from oscillations of air or water has developed into the tone discriminations of the skilled violinist; the undifferentiated response of the protozoön to mechanical stimulation at any part of its body has become the finger sense of the mechanician. Now an increase in the number of discriminable sensations within a given sense department means one of two things, sometimes both. Either qualitative discrimination becomes more highly developed, or local discrimination grows finer. We have an example of the first in the series of auditory sensations; of the second in the sense of touch, where qualitative uniformity, comparatively speaking, is compensated for by exceedingly fine localization; and of both in the sense of sight.

Further, this process of growth in discriminative power has been conditioned, like all the phenomena of organic development, by the vital needs of the organism. At every stage of evolution, the creature's energy of discrimination, so to speak, is limited, and must be expended in a direction that will best aid its possessor to survive. From this point of view, we find that the facts concerning the power to discriminate, qualitatively and locally, in different sense departments may be grouped under two laws.

First, qualitative discrimination has been developed with reference to stimuli that do not immediately hurt or help the organism.

Second, stimuli that are or may be harmful or helpful at the moment of their application have given rise to local discrimination at the expense of qualitative distinctions.

As regards the first principle, it is clear that stimuli such as light or sound, which cannot directly and instantaneously affect the organism's life, are those which have given rise to the greatest number of qualitatively distinguishable sensations. The reason is that, since it is unnecessary for the organism to make, in instant response to such stimuli, movements accurately adapted to their location, it is at liberty to expend its psychic energies on qualitative analysis. Time can be taken to discover what the stimuli are, because it is not so desperately necessary to distinguish where they are and act accordingly. Local discrimination in these senses may go hand in hand with qualitative discrimination, as in the case of sight, but it will not obscure it. The sense of taste is a further illustration. It is the poorest of the group, sight, hearing, smell, and taste, in the number of its qualities. It is also the one of these four whose stimuli do come into direct contact with the body. That it should possess as many qualities as it does may well be due to the fact that its stimuli, though touching the body, do not touch it at the localities where they can harm or help; hence local discrimination is unnecessary. Taste stimuli come into contact with the body in the mouth; their first chance to hinder or help the organism's welfare comes ordinarily further on in the alimentary canal.

On the other hand, the two classes of sensations that illustrate clearly how qualitative discrimination may be swamped through the immediate need for local discrimination are touch sensations and, preëminently, sensations of pain. Here the stimulus is not merely in contact with the organism; it is where it may injure, or actually is injuring. Immediate motor response adapted to the location of the stimulus is demanded; there is no time for qualitative investigation. To say that the contact senses have fewer qualities than sight and hearing because the variety of stimuli for sight and hearing is greater, is obviously to beg the question completely. There is as much variety in the chemical constitution of bodies as there is in the ether or air disturbances which they send to us. *A priori*, this variety might well have been represented by an equal variety of touch and pain qualities; what is lacking is not stimulus differences, but sensory discrimination. The motor reaction demanded by such stimuli has been too immediate; there has been no time for more than a vague cognition of the 'what.'

We said at the outset that this principle would throw light also upon the problem of the rise of free images. Whatever one's theory of the nature of nervous action may be, it is evident that the reproduction of a sensory image by central excitation demands that its original stimulus shall have left upon the nervous substance a relatively permanent effect. The stages of development in response to stimulation may be classed as three. First, there is the primitive condition where the animal does not learn by individual experience. A stimulus entering such an organism, and sending its energy out again through whatever motor paths are available, leaves so little effect upon the substance through which it passes that the animal behaves towards a second stimulus of the same kind precisely as it did towards the first. In the next place, we have that stage of development where the animal learns by experience, without, however, having the power to recall an image of its experience. This, if we are to believe recent investigations of the animal mind, is probably the stage at which many animals quite high in the scale remain. The chick stung by a bee cannot later have the image of a bee suggested to him, but he can and does refrain from picking up the next bee he sees. Here the stimulus has modified the behavior of the animal. The permanent effect it has left upon the nervous substance would seem to involve chiefly the motor paths, the direction of the outgoing current. But renewed stimulation from without is necessary before this modification makes itself apparent. Finally, when we have the possibility of an image, purely centrally excited, and not leading immediately to movement, when a process similar to the original one may be set up, not by an influx of energy from without, but by the weaker nervous current coming from some other central sensory region, it is evident that the nervous substance must have been far more profoundly affected by the original stimulus than it was at either of the earlier stages. Now what characteristics of a stimulus would determine how thoroughly and deeply it would affect the nervous substance through which it passed? Its intensity, the quantity of energy in it, of course; but still more emphatically the length of time that energy remained in the centers in question, without being drained off into motor paths and transformed into bodily movement. Not merely the strength, but the duration of the current determines how deep a path it shall dig out for itself.

We have already seen that stimuli which are in a position to help or harm an organism at the instant of their contact with its body are stimuli demanding immediate motor reaction, adapted especially to their location. In such cases, the energy of the stimulus is deflected at once into the appropriate motor path; its modifying effect is produced upon the regions of motor discharge, but it is not delayed long enough in the sensory regions to produce any permanent change there. It is probable that the consciousness of such stimulation is not very intense or distinct. But when the creature has developed a capacity to be affected by light and sound, which cannot help or harm at the moment of their action upon its body, then reaction may be postponed; then the current of energy sent by the stimulus into the nervous substance is not at once drained off, but may linger sufficiently long to produce whatever alteration, whatever impress upon sensory centers, is needful to insure their subsequent functioning as the basis of a free image. Delayed reaction, made gradually possible by increasing sensitiveness of the organism to stimuli only indirectly affecting its welfare, is then the source of the image-forming power. May not the same principle help to explain also why it is that the fully developed mind gets its clearest and most controllable images from the senses whose stimuli do not indicate direct contact of a beneficial or harmful object with the body; while the closer and more direct the stimulation, as for instance in touch and organic sensations, the obscurer is the image?

A final thought suggests itself in this connection. The so-called higher senses, those with greatest qualitative differentiation, with clearest images, and with stimuli demanding, under primitive vital conditions, least immediate and instant reaction, are also the senses giving rise to æsthetic feelings. That is, the affective tone of impressions from these senses is largely dependent on the relations of the elements rather than on their character. This fact is surely connected with the possibility of delayed motor response in the higher senses. The relation between two simple sense impressions could not come into clear consciousness, either on its own account or as represented by a feeling, unless neither of the impressions required instant reaction. There is no such thing as an æsthetics of touch or organic sensations, because here there has been no time, between stimulus and reaction, for dwelling on the relation between the sensory effects of different stimuli. In a word, upon the possibility of reacting to stimulation that neither hurts nor helps the organism at the moment of its operation, may rest the basis of all higher mental development.

MARGARET FLOY WASHBURN.

VASSAR COLLEGE.